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S190 INTERPRETATION TECHNIQUES DEVELOPMENT AND APPLICATION TO NEW YORK STATE WATER RESOURCES

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The objective of this investigation is development of interpretation techniques for satellite monitoring of lake eutrophication. Imagery from the S190A and S190B experiments is to be utilized to study eutrophication processes in three lakes important to New York State water resources: Lake Ontario, Conesus Lake and Chautauqua Lake.

During this reporting period the first set of Skylab imagery was received. Skylab-3 imagery from 9 and 10 September (days 252 and 253) arrived in late December (S190A), and mid-January (S190B). Additional imagery from 15 September (day 258), and 19 September (day 262), is expected within the next reporting period. We have drawn the following conclusions from preliminary analyses of the 9 and 10 September imagery.

The overall quality of the imagery is excellent. The S190A color imagery from 9 September was calibrated using darkest scene elements, and targets whose reflectances had been measured [beaches, large coal piles, and concrete runways]. The resultant range of blue reflectances found over Lake Ontario was ~1.6 to 4.7%. Aircraft overflight data obtained on the same date yielded a reflectance range of ~1.6 to 4.4%. Similar correspondence exists with the lake reflectances in the green spectral band. Correlation of the spatial patterns of the Skylab imagery with those inferred from the aircraft imagery also appears quite good. A significant improvement provided by the satellite imagery is the unique definition of spatial patterns within the lake made possible because the entire lake is imaged. One of the more difficult aspects of the interpretation of aircraft imagery, or the interpretation of ship data obtained at stations over a large lake, is the extraction of spatial patterns from the available data. The S190 imagery has exceeded our expectations in providing improvement in the important area of understanding what is happening to the lake as a whole.

As expected, the flare component of exposure was found to be of the order of 70% of the total lake exposure. As a result great care must be taken in analysis of the data, since a small error in determination of flare component results in a large error in lake reflectance.

Analyses of the red layer data indicate that the red layer is badly underexposed for purposes of lake analyses. Lake densities in the red layer appear on the shoulder of the red D-log E curve at values very close to maximum film density. The origin of this problem lies in the fact that the red reflectance for a lake such as Ontario is ~1% - a factor of 2 to 3 less than the blue and green reflectances, and a factor of 4 to 5 less than any other target in the red (e.g. vegetation, coal). The red layer data, therefore, cannot be used for the lake analyses. The blue and green data, while on the straight line portions of their respective film response curves, are also close to the shoulders of the curves. We therefore recommend that exposures be increased by one-half to one stop on any future missions on which such lake analyses are being conducted. Such an exposure increase would permit red layer data to be utilized. Identical comments concerning underexposure and changes in exposure on future missions apply to the panchromatic film filtered through the red spectral filter.

We do not regard the lack of red data to be a major problem. Analyses of Lake Ontario conducted as part of the International Field Year on the Great Lakes indicate that the blue and green data are most important for the lake studies in particular the ratio of blue to green reflectances. The goals of the Skylab lake eutrophication study should, therefore, be met using only the blue and green information.

The S190A imagery obtained to date contains excellent coverage of Lake Ontario, but no coverage of either Conesus or Chautauqua Lakes. The S190B imagery contains coverage of Conesus Lake, but unfortunately only on unfiltered panchromatic film. Coverage of the Finger Lakes on the S190A imagery is very good, and we expect to perform imagery analysis on these lakes in lieu of the Conesus and Chautauqua studies. We are hopeful that imagery still to be obtained from the 15 and 19 September orbits will have coverage of Conesus and Chautauqua Lakes.

During the next reporting period we hope to complete analyses of the 9 and 10 September imagery, begin analyses of the 15 and 19 September imagery, and correlate the satellite data from 9 and 10 September with the aircraft data obtained during 1972 and 1973.